

University of Groningen

Limited validity of parental recall on pregnancy, birth, and early childhood at child age 10 years

Jaspers, Merlijne; de Meer, Gea; Verhulst, Frank C.; Ormel, Johan; Reijneveld, Sijmen A.

Published in:
Journal of Clinical Epidemiology

DOI:
[10.1016/j.jclinepi.2009.05.003](https://doi.org/10.1016/j.jclinepi.2009.05.003)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2010

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Jaspers, M., de Meer, G., Verhulst, F. C., Ormel, J., & Reijneveld, S. A. (2010). Limited validity of parental recall on pregnancy, birth, and early childhood at child age 10 years. *Journal of Clinical Epidemiology*, 63(2), 185-191. <https://doi.org/10.1016/j.jclinepi.2009.05.003>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

Limited validity of parental recall on pregnancy, birth, and early childhood at child age 10 years

Merlijn Jaspers^{a,*}, Gea de Meer^a, Frank C. Verhulst^b, Johan Ormel^c, Sijmen A. Reijneveld^a

^aDepartment of Health Sciences, University Medical Center Groningen, University of Groningen, The Netherlands

^bDepartment of Child & Adolescent Psychiatry, Erasmus MC-Sophia, Erasmus University Medical Center, Rotterdam, The Netherlands

^cDepartment of Psychiatry, University Medical Center Groningen, University of Groningen, The Netherlands

Abstract

Objective: Evidence on the validity of parental recall of early childhood behavior is lacking. Our aim was to examine the validity of parental recall at child age 10–12 years for maternal lifestyle during pregnancy, the birth characteristics, and early childhood behavior.

Study Design and Setting: The study population comprised 2,230 children and their parents. Children aged 10–12 years were recruited from elementary schools (response: 76.0%). Parents were asked to recall lifestyle during pregnancy, birth characteristics, and childhood behavior at age 4–6 years. Recalled data were compared with information registered by Preventive Child Healthcare (PCH) from birth onwards.

Results: For birth weight and gestational age, we found no systematic difference between recalled and PCH-registered data; 95% limits of agreement were ± 1.2 pounds (600 g) and ± 2.4 weeks, respectively. For maternal alcohol use during pregnancy and early childhood behavior problems, Cohen's kappas were low (0.03–0.11). Compared with PCH registration, parents tended to overreport at age 10–12 years. In contrast, kappa was high for maternal smoking during pregnancy (0.77).

Conclusion: Retrospectively collected information on lifestyle during pregnancy, birth, and early childhood behavior is sometimes biased, which limits its value in estimating the contribution of early-life adversity to health in later life. © 2010 Elsevier Inc. All rights reserved.

Keywords: Validity; Recall bias; Parent; Child; Early-life adversity; Mental health

1. Introduction

The period from conception until school age is considered to be extremely important for children's socioemotional development [1–3]. It can be a “window of opportunity” [4] and a “window of vulnerability,” depending on the outcome, and it can offer great opportunities to improve further life by reducing adverse environmental factors and/or empowering positive factors.

Early-life factors that are associated with future mental and physical health of the child concern either pregnancy, birth, or early childhood [5–14]. Pregnancy factors are, for example, maternal smoking, alcohol use, drug abuse, medication, and disease during pregnancy. These have been shown to be risk factors for the development of psychopathology [5,7–9,11], growth retardation, respiratory problems, cardiovascular disease, and other health problems [6,13]. Similarly, birth factors,

such as low birth weight and premature birth, can lead to a number of health problems [8,13]. Early childhood factors are, for example, toddler sleep problems [10,14], early eating problems [15,16], and preschool problems with social behavior [2], which are predictors for later mental health problems.

Ideally, the effects of early-life factors should be considered in follow-up studies in which information on these factors is collected from various sources (e.g., parents and professional assessment) in the period from conception to school age; follow-up extends to adolescent or even adult age, and attrition and loss-to-follow-up rates are low. However, most studies rely on retrospective data collection, which may introduce information bias. This may concern recall bias because of differences in validity of subject recall, marked by an over- or underreport of information. Or it may, for instance, be rumination bias, which occurs when people with a disease tend to think harder about their prior exposures than healthy people, causing them to systematically remember exposure differently [17]. This distorts the measurement of the association between exposure and disease. The magnitude and direction of this distortion are difficult to predict.

Many previous studies on early risk factors for adverse future mental health relied on retrospectively collected data

* Corresponding author. Department of Health Sciences, University Medical Center Groningen, University of Groningen, P.O. Box 196, 9700 AD Groningen, The Netherlands. Tel.: +31-50-363-2670; fax: +31-50-363-6251.

E-mail address: M.Jaspers@med.umcg.nl (M. Jaspers).

and included a limited number of risk factors. The validity of data collected retrospectively needs to be examined before using them to estimate relationships with health or developmental outcomes. Regarding early-life factors, previous studies found good recall for maternal smoking during pregnancy [18–20], for gestational age [20–22], and for birth weight [19,20,23–26], but not for alcohol use during pregnancy [18,19]. However, most of these studies covered a limited period of time and did not consider a combination of variables. So far, no studies are available on the validity of parental recall of early childhood behavior and neither of pre- and perinatal factors.

The aim of the current study is to examine the validity and precision of recall of maternal lifestyle during pregnancy, birth characteristics, and early childhood behavior in a community-based sample. For this purpose, we compared data on prenatal and early-life characteristics collected at child age 10–12 years with data registered by Preventive Child Healthcare (PCH) from birth onwards.

2. Methods

2.1. Study population and procedure

The Tracking Adolescents' Individual Lives Survey (TRAILS) is a prospective cohort study among Dutch 10- to 12-year-old children aiming at adolescent psychosocial development and mental health. The TRAILS target sample was recruited in 2001 from elementary schools in five municipalities in the northern part of The Netherlands [27,28]. Of all children approached for enrollment in the study ($N = 3,145$), 6.7% were excluded because of mental or physical incapacities or language problems. Of the remaining 2,935 children, 76.0% ($N = 2,230$, mean age = 11.09, standard deviation [SD] = 0.56, 50.8% girls), both child and parent, agreed to participate. Responders and nonresponders did not differ with respect to the prevalence of teacher-rated problem behavior or regarding associations between socio-demographic variables and mental health outcomes [27]. Data collection occurred by parent-completed questionnaire and a home visit by trained interviewers. Furthermore, participants were asked for permission to retrieve the child's file from PCH. The PCH provides health and developmental monitoring to all Dutch children from birth until age 19 years, and the participation rate is over 90% [29,30].

For the current analyses, we used data from the PCH files on maternal lifestyle during pregnancy, birth characteristics, and early childhood behavior, and data from the first wave of TRAILS when the child was 10–12 years of age. Data of TRAILS wave 1 were collected by well-trained interviewers during a home visit, including parent-completed questionnaires that comprised the child behavior checklist (CBCL) and sociodemographic variables. Because surveillance protocols differed between the three participating PCH services, numbers for included variables differ considerably.

2.2. Maternal lifestyle during pregnancy

Maternal lifestyle during pregnancy concerned smoking and alcohol use. In TRAILS, these were asked for by the following questions: “How much did the mother smoke during pregnancy?” and “How much alcohol did the mother drink during pregnancy?” The answer categories comprised five categories varying from “never” to “more than two packs of cigarettes a day” for smoking, and from “never” to “more than 20 glasses per week” for alcohol use. For the current analyses, we compared “never” with the other categories combined (i.e., “ever”) for smoking or alcohol use. In the PCH files, smoking and alcohol use were assessed as: “Did the mother smoke during pregnancy?” and “Did the mother use alcohol during pregnancy?” respectively, similarly dichotomized as ever/never.

2.3. Birth characteristics

Birth characteristics concerned gestational age and birth weight. In TRAILS, these were asked in the form of the following questions: “How much did the child weigh at birth?” and “How many weeks did the pregnancy last?” in pounds (500 g) and weeks, respectively, which present common measures of birth weight and gestational age in The Netherlands. In the PCH files, these data were registered in grams and days, respectively, as provided by the obstetrician or midwife. Aiming at a similar precision of TRAILS and PCH data, the PCH data on birth weight were converted to pounds (500 g), and those on gestational age were converted to completed weeks.

2.4. Early childhood behavior

Early childhood behavior concerned “sleeping problems,” “eating problems,” and “social behavior problems” at age four to six years. In the TRAILS data collection, parents filled out a questionnaire on the child's behavior when it was in kindergarten (age: four to six years). Sleeping and eating problems were considered to have occurred if parents gave a confirmative answer on the following questions: “Didn't ... (name child) want to eat?”; “Did ... (name child) have problems falling asleep?”; “Did ... (name child) have problems sleeping through the night?” Social behavior problems were assessed by the following questions: “In comparison with other children: ...” “was your child quickly anxious?”; “was your child shy?”; “was your child quick tempered?” Answering categories concerned a 5-point Likert scale (from “much more” to “much less”), and problems were considered to have occurred if parents reported “more” or “much more.”

In the PCH files, “sleeping or eating problems” were assessed by the following predefined questions: “Does the child have any problems eating?” and “Does the child have any sleeping problems?” “Social behaviour problems” were measured based on the information that the PCH professional registered at the following predefined

items in the records “how is the child’s behaviour?”, “social behaviour?”, and “psychosocial functioning?”. For each, the following descriptions could be used: “quick tempered,” “shy,” “anxious,” or “no problem,” the latter being compared with the other categories. A social behavior problem was considered to be present only if any of these three items was filled out affirmatively.

2.5. Child behavior checklist

Behavioral and emotional problems at age 10–12 years were assessed by the parent-completed CBCL for ages 4–18 years, an internationally validated questionnaire for child emotional and behavioral problems [31,32]. In the current study, we used the Total Problems score and two broadband scales, Externalizing and Internalizing Problems. The Total Problems score is the sum of all individual item scores (118 items). Internalizing Problems consists of the Anxious/Depressed, the Somatic Complaints, and the Withdrawn/Depressed syndrome scales. Externalizing Problems consists of the Aggressive Behaviour and Delinquent Behaviour syndrome scales. Cases were allocated to a normal range or a clinical (elevated) range, using the age- and gender-specific 90th percentiles of the Dutch normative sample for the scales concerned as cutoff [32].

2.6. Statistical analysis

Statistical analyses were performed using SPSS version 12 for Windows. For continuous variables, that is, gestational age and birth weight, the agreement of values from the two sources (PCH registration and TRAILS parental recall) was estimated using the stepwise method described by Bland and Altman [33,34]. First, we evaluated the data for systematic differences between PCH-registered and recalled values. Using a paired *t*-test, we tested if the mean differences between the two birth weights (PCH registered vs. TRAILS recalled) deviated from 0, to test for systematic deviation. Subsequently, the difference between PCH-registered and recalled values were plotted against their mean values to evaluate a potential relationship of deviation with mean scores. After exclusion of systematic differences, 95% limits of agreement were calculated as the mean differences \pm 2 SD, which mark the precision of the association between the two measures, that is, random deviation.

Cohen’s kappa (agreement adjusted for chance agreement) values were calculated as a measure of concordance between registered (PCH) and recalled (TRAILS) dichotomous variables, that is, maternal lifestyle during pregnancy and early childhood behavior. Cohen’s kappas between 0.40 and 0.75 were considered as moderate to good agreement, and above 0.75 as excellent. If kappa was below 0.40, then we also calculated the percentage over- and underreports (where differences were assessed, using McNemar tests, where $P < 0.05$ was considered a significant difference).

Parental recall can be influenced by the occurrence of child behavioral and emotional problems at the moment of recall; hence, we examined the agreement between PCH registration and TRAILS parental recall for children with and without an elevated CBCL score at the moment of recall. We did this using logistic regression for the outcomes most likely to be affected \pm maternal lifestyle during pregnancy, birth characteristics, and early childhood behavior.

3. Results

3.1. Description of sample

Of the 2,230 TRAILS participants, 2,139 (96%) parents gave permission to retrieve the child’s file from the PCH. Out of these, 88% could be traced ($N = 1,879$ files, mean age = 11.06, SD = 0.54, 50.9% girls). Parent-recalled TRAILS data at age 10–12 years differed with statistical significance between children with retrieved PCH data and with nonretrieved data for two out of the nine outcomes assessed. These were parent-reported maternal alcohol use during pregnancy (19% for the retrieved vs. 15% for the others; $P < 0.05$), and problems with eating at child age four to six years (18% vs. 13%, respectively; $P < 0.05$). A considerable proportion of data missed on some variables in the retrieved PCH files, further called PCH-item nonresponse, ranging from 64.2% regarding maternal behaviors to 30.4% regarding early child behaviors (Table 1). PCH-item nonresponse rates varied in particular between the five sites of data collection, each site representing a different PCH service. Regarding maternal smoking and alcohol use, PCH-item nonresponse was 96.9% in one site compared with 38.8% for the other four sites ($P < 0.001$). After adjustment for site, PCH-item nonresponse for these maternal behaviors did not vary by sociodemographic factors (all $P > 0.05$). Regarding early childhood behaviors also, PCH-item nonresponse did not vary by any of these background characteristics.

In the retrieved PCH files, 37.3% of the mothers had a low educational level, 35.5% intermediate, and 27.1% had a high educational level. Fathers had a higher educational level on average, that is, 32.4% had low, 32.2 had intermediate, and 35.4% had high educational levels. Of all families, 21.0% ($N = 454$) was divorced (at child age 11 years). 8.7% of the children had no siblings, 48.9% had one, 29.5% had two, and 12.9% had three or more.

3.2. Birth characteristics

Table 2 shows the mean values for birth weight in pounds and gestational age in weeks for parent-recalled TRAILS values and PCH-registered values shortly after birth. For both outcomes, the mean values differed with statistical significance, but the actual differences were close to zero and not clinically relevant, that is, 0.05 pounds (25 g) for birth weight

Table 1

Prevalence rate (dis)agreement and kappas for maternal lifestyle during pregnancy and early childhood behavior according to registered (PCH) and recalled (TRAILS) data

	% Prevalence		% Agreement		% Disagreement		Kappa (95% CI)
	PCH	TRAILS	Denial	Confirmation	Overreporting	Underreporting	
<i>Maternal lifestyle during pregnancy</i>							
Smoking (<i>N</i> = 708)	33.3	32.2	62.0	27.7	4.7	5.6	0.77 (0.71, 0.82)
Alcohol use (<i>N</i> = 679)	6.0	22.1	74.2	2.4	19.7 ^a	3.7 ^a	0.08 (0.00, 0.19)
<i>Early childhood behavior</i>							
Sleeping problems (<i>N</i> = 666)	3.0	18.1	80.4	1.5	16.6 ^a	1.5 ^a	0.10 (0.00, 0.22)
Eating problems (<i>N</i> = 673)	13.4	13.1	77.1	3.6	9.5	9.8	0.15 (0.00, 0.19)
Shyness (<i>N</i> = 1,307)	3.4	23.7	74.8	1.9	21.8 ^a	1.5 ^a	0.09 (0.01, 0.16)
Anxiety (<i>N</i> = 1,308)	0.6	15.8	83.9	0.3	15.5 ^a	0.3 ^a	0.03 (0.00, 0.11)
Quick tempered (<i>N</i> = 1,309)	3.0	15.7	82.1	0.8	14.9 ^a	2.2 ^a	0.03 (0.00, 0.09)

Abbreviations: PCH, Preventive Child Healthcare; TRAILS, Tracking Adolescents' Individual Lives Survey; CI, confidence interval.

^a Significant difference between over- and underreporting, $P < 0.05$ (McNemar tests).

and 0.08 weeks (0.6 days) for gestational age. The statistical significance is likely because of overpowering of the sample size with respect to the estimation of a clinically relevant difference in birth weight and gestational age.

Plots of the differences between recalled and reported values against their mean values (Fig. 1A and B) showed no relation between the difference and mean values.

The 95% limits of agreement of recalled compared with registered values were 0.0 ± 1.2 pounds (600 g) for birth weight and 0.0 ± 2.4 weeks (17 days) for gestational age, that is, $\pm 17.4\%$ and $\pm 6.0\%$ of the mean values for birth weight and gestational age, respectively.

3.3. Maternal lifestyle during pregnancy

Concordance between recalled (TRAILS) and PCH-registered maternal lifestyle during pregnancy was high for maternal smoking (kappa: 0.77 [95% confidence interval (CI): 0.71, 0.82]) and low for maternal alcohol use during pregnancy (kappa 0.09 [95% CI: 0.00, 0.19]) (Table 1). For smoking, rates of underreporting and overreporting were equal (4.7% and 5.6%, McNemar test: $P > 0.10$), but parents tended to overreport retrospectively at age 10–12 years maternal alcohol use during pregnancy: 19.7% overreport

compared with 3.7% underreporting (McNemar test: $P < 0.001$).

3.4. Early childhood behavior

Table 1 also shows concordance for eating, sleeping, and social behavior (all at child age four to six years). For all studied markers of early childhood behavior, concordance was low, kappa values ranging from 0.03 to 0.10. Overreporting occurred more frequently than underreporting for most outcomes (McNemar test: $P < 0.001$), except for eating problems (McNemar test: $P > 0.10$). We repeated these analyses for severe child-behavior problems, if parents reported that their child had “much more problems compared to other children.” The proportion of overreporting reduced to 2.4%, 2.4%, and 2.8% for quick temperedness, anxiety, and shyness, respectively. However, kappa values remained low (0.02–0.11).

Parental recall may be related to child emotional or behavioral problems. Therefore, logistic regression analyses were performed on the relationship of (dis)agreement between registered and recalled information and the parent-completed CBCL. None of the associations between (dis)agreement and dichotomized CBCL scores (clinical vs. normal) was significant, neither for the CBCL Total Problems score, nor for Internalizing or Externalizing Problems (results not shown).

4. Discussion

In this large community-based sample, we studied the validity of parental recall over a 10- to 12-year period for maternal lifestyle during pregnancy, birth characteristics, and early childhood behavior. Results show that parental recall of birth weight and gestational age is valid (no systematic error) but not very precise. For maternal alcohol use during pregnancy, and early child behavior, recall was poor. A good recall was observed only for maternal smoking during pregnancy.

Table 2

Difference between registered (PCH) and recalled (TRAILS) values for birth weight and gestational age

Values	Birth weight in units of 500 g (SD) (<i>N</i> = 1,691)	Gestational age in weeks (SD) (<i>N</i> = 1,696)
Recalled ^a	6.8 (1.2)	39.7 (1.8)
Registered ^b	6.9 (1.1)	39.7 (1.9)
Mean difference (95% CI)	+0.05 (0.02, 0.16)	−0.08 (−0.13, −0.04)

Abbreviation: SD, standard deviation.

^a Retrieved from TRAILS data collected at child age 10–12 years.

^b Retrieved from the PCH files, recorded at birth.

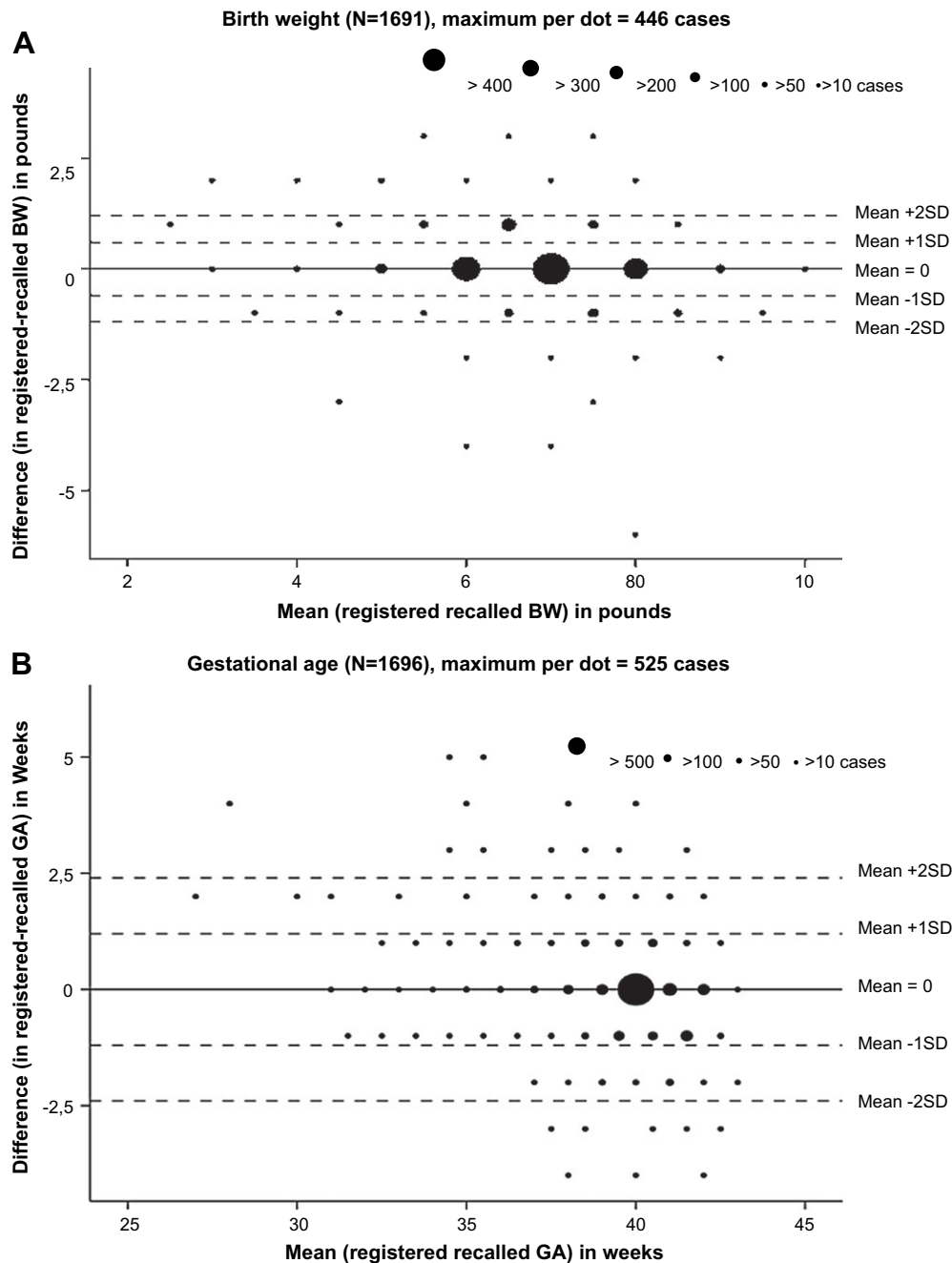


Fig. 1. Plot of difference between recalled and registered values against the mean values. A. Birth weight (BW; $N = 1,691$), maximum per dot = 446 cases. B. Gestational age (GA; $N = 1,696$), maximum per dot = 525 cases.

To our knowledge, this study is the first to examine the validity of parental reports of a number of prenatal and early-life factors over a 10- to 12-year period, using data collected in a community-based setting at both time points. Moreover, this study is the first of its kind that examines parental recall of early child-behavior characteristics, which is considered highly relevant for the development of psychopathology later in life.

For birth weight and gestational age, no systematic difference was observed for recalled and PCH-registered data, which confirms previous studies [19–26]. However, when

taking into consideration the precision of recall, the use of recalled data adds considerable random error to all findings. For birth weight, the 95% range of recalled values deviated 17.4% from the mean value, and for gestational age, 6.0%. Methodologically, these findings also clearly show the merits of the rigorous assessment procedure of agreement as proposed by Bland and Altman [33,34].

For maternal lifestyle during pregnancy, our results are in agreement with previous studies that also observed an acceptable agreement for smoking and a poor one for alcohol use [18,19]. The recall of early child behavior was poor

as well. However, the total rate of agreement (confirmation and denial put together, Table 1) for maternal lifestyle during pregnancy and of the child at age four to six years was high. This counterintuitive finding can largely be explained by the low proportions of confirmations on both occasions (TRAILS and PCH). The kappa statistic has been shown to be sensitive to extremes in prevalence and unbalanced margin totals leading to lower kappa values [35], but this explains the low kappa value in our study to a very limited degree. The discordance for the child-behavior problems can also be caused by the fact that the PCH files did not mention the length of time these problems lasted, whereas the question at age 11 years was focused on the whole kindergarten period. Finally, child-behavior problems in this study mostly comprised internalizing behavior, that is, anxiousness, shyness, and sleep problems. Faraone et al. [36] showed that parental recall of psychopathology of their child after one year was much better for externalizing than for internalizing problems. Our findings show that this holds to an even higher degree if the period of recall is longer.

Alcohol use during pregnancy and early child behavior were reported more frequently in the TRAILS data compared with PCH-registered data. This may be because of either an overreporting at age 10–12 years or an underreporting in the PCH files. A likely source of overreporting might be child behavioral and emotional problems at 10–12 years of age. In this population, however, parental recall was unrelated to child emotional or behavioral problems. An underreporting in the PCH registration may have occurred for alcohol use during pregnancy. At the time of PCH registration in our study population, the early 1990s, there was no consensus on the effect of nonhabitual alcohol use on fetal development. However, kappa values did not change when we focused on more frequent use. In addition, parents may have underreported alcohol use because of the setting and timing of PCH registration. Details regarding lifestyle during pregnancy were asked for during the first PCH visit only, which is shortly after birth. The setting and timing may evoke emotions that lead to recall [37].

The strengths of this study are its large, community-based sample and the preventive health care setting. Moreover, we made use of data registered during routine health and developmental monitoring offered to all Dutch children, and collected and registered according to a highly standardized format. We retrieved 88% of the PCH files as expected based on the 90% participation reported from national data [30]. Hence, there is no or limited bias from parents' report. However, information on reasons of nonretrieval was not available.

Our study has some limitations. First, though we consider the PCH data to be most valid, we cannot exclude that these are subject to some bias too. In particular, parent-reported information may have been influenced by the reporting to a PCH professional and the registration of that professional. Considering this fact, only birth weight and

gestational age registered in the PCH files can be taken as true reference values. Second, the low prevalence of some behavior may have resulted in somewhat too low kappa estimates, but the impact of this is rather small. Third, some of the outcomes as studied were only registered in a part of the PCH encounters, which could have introduced bias if occurring in association with child characteristics. However, the site appeared to be the only predictor of this nonresponse and only regarding maternal behaviors. This indicates that the missingness of some items is, in particular, because of differences between services in their registration policies, as at that period, each site was served by a different PCH service. Apparently, in that period, services differed in their policies on how to spend the very limited time per encounter (approximately 10–15 minutes); in most services, the registration of past maternal behavior had a much lower priority than current child behavior. Finally, the nonresponse of 24% in the TRAILS study could have led to selection bias in our findings. However, we found no differences between responders and nonresponders in the prevalence of teacher-rated problem behavior or regarding associations of sociodemographic variables and mental health outcomes, which makes the occurrence of selection bias rather unlikely.

To summarize, we observed a poor parental recall after a 10- to 12-year period for maternal lifestyle during pregnancy, birth characteristics, and early childhood behavior, which mostly was because of overreporting at age 10–12 years. This should be taken into account when asking retrospectively about these events, either by researchers or by clinicians. We conclude that retrospectively collected information of early-life adversities is of limited value for estimating the contribution to child (public) health.

Acknowledgments

TRAILS has been financially supported by various grants from the Netherlands Organization for Scientific Research NWO (Medical Research Council program grant GB-MW 940-38-011; ZonMW Brainpower grant 100-001-004; ZonMw Risk Behavior and Dependence grants 60-60600-98-018 and 60-60600-97-118; ZonMw Culture and Health grant 261-98-710; Social Sciences Council medium-sized investment grants GB-MaGW 480-01-006 and GB-MaGW 480-07-001; Social Sciences Council project grants GB-MaGW 457-03-018, GB-MaGW 452-04-314, a GB-MaGW 452-06-004; NWO large-sized investment grant 175.010.2003.005); the Sophia Foundation for Medical Research (projects 301 and 393), the Dutch Ministry of Justice (WODC), and the participating universities.

This research is part of the Tracking Adolescents' Individual Lives Survey (TRAILS). Participating centers of TRAILS include various departments of the University Medical Center and University of Groningen, the Erasmus University Medical Center Rotterdam, the University of

Utrecht, the Radboud Medical Center Nijmegen, and the Trimbos Institute, all in The Netherlands. The principal investigators were Prof. Dr. J. Ormel (University Medical Center Groningen) and Prof. Dr. F.C. Verhulst (Erasmus University Medical Center). We like to thank the Preventive Child Healthcare Services in Drenthe, Friesland, and Groningen for their permission to retrieve the PCH files from their archives. We are grateful to all adolescents, their parents and teachers who participated in this research, and to everyone who worked on this project and made it possible.

References

- [1] Cicchetti D, Cohen DJ. Perspectives on developmental psychopathology. New York: Wiley; 1995.
- [2] Mesman J, Koot HM. Early preschool predictors of preadolescent internalizing and externalizing DSM-IV diagnoses. *J Am Acad Child Adolesc Psychiatry* 2001;40:1029–36.
- [3] Sroufe LA. In: Cicchetti D, Toth SL, editors. Rochester symposium on developmental psychopathology, Pathways to adaptation and maladaptation: psychopathology as developmental deviation, Vol. 1. Hillsdale, NJ: Erlbaum; 1989. p. 13–40. Developmental psychopathology: an emerging discipline.
- [4] Barker DJ, Bergmann RL, Ogra PL. Concluding remarks. The window of opportunity: pre-pregnancy to 24 months of age. *Nestle Nutr Workshop Ser Pediatr Program* 2008;61:255–60.
- [5] Eaton WW, Mortensen PB, Thomsen PH, Frydenberg M. Obstetric complications and risk for severe psychopathology in childhood. *J Autism Dev Disord* 2001;31:279–85.
- [6] Haberg SE, Stigum H, Nystad W, Nafstad P. Effects of pre- and post-natal exposure to parental smoking on early childhood respiratory health. *Am J Epidemiol* 2007;166:679–86.
- [7] Hook B, Cederblad M, Berg R. Prenatal and postnatal maternal smoking as risk factors for preschool children's mental health. *Acta Paediatr* 2006;95:671–7.
- [8] Indredavik MS, Vik T, Heyerdahl S, Kulseng S, Brubakk AM. Psychiatric symptoms in low birth weight adolescents, assessed by screening questionnaires. *Eur Child Adolesc Psychiatry* 2005;14:226–36.
- [9] Linnet KM, Dalsgaard S, Obel C, Wisborg K, Henriksen TB, Rodriguez A, et al. Maternal lifestyle factors in pregnancy risk of attention deficit hyperactivity disorder and associated behaviors: review of the current evidence. *Am J Psychiatry* 2003;160:1028–40.
- [10] Mattes E, Kendall GE, Susser ES, McKeague IW, Silburn SR, Stanley FJ, et al. Sleep problems at age 2 as a predictor of mental health from middle childhood to adolescence: the Western Australian Pregnancy Cohort (RAINE) study. *Early Human Dev* 2007;83:S57. Oral presentation.
- [11] Olsen EM, Skovgaard AM, Weile B, Jorgensen T. Risk factors for failure to thrive in infancy depend on the anthropometric definitions used: the Copenhagen County Child Cohort. *Paediatr Perinat Epidemiol* 2007;21:418–31.
- [12] Rice F, Jones I, Thapar A. The impact of gestational stress and pre-natal growth on emotional problems in offspring: a review. *Acta Psychiatr Scand* 2007;115:171–83.
- [13] Saigal S, Doyle LW. An overview of mortality and sequelae of pre-term birth from infancy to adulthood. *Lancet* 2008;371:261–9.
- [14] Thunström M. Severe sleep problems in infancy associated with subsequent development of attention-deficit/hyperactivity disorder at 5.5 years of age. *Acta Paediatr* 2002;91:584–92.
- [15] Laucht M, Esser G, Schmidt MH. [Behavioral disorders in infants and young children: a contribution to psychopathology of early childhood]. *Z Kinder Jugendpsychiatr* 1992;20:22–33.
- [16] McDermott BM, Mamun AA, Najman JM, Williams GM, O'callaghan MJ, Bor W. Preschool children perceived by mothers as irregular eaters: physical and psychosocial predictors from a birth cohort study. *J Dev Behav Pediatr* 2008;29:197–205.
- [17] Sackett DL. Bias in analytic research. *J Chronic Dis* 1979;32:51–63.
- [18] Delgado-Rodriguez M, Gomez-Olmedo M, Bueno-Cavanillas A, Garcia-Martin M, Galvez-Vargas R. Recall bias in a case-control study of low birth weight. *J Clin Epidemiol* 1995;48:1133–40.
- [19] Rice F, Lewis A, Harold G, van den BM, Boivin J, Hay DF, et al. Agreement between maternal report and antenatal records for a range of pre and peri-natal factors: the influence of maternal and child characteristics. *Early Hum Dev* 2007;83:497–504.
- [20] Yawn BP, Suman VJ, Jacobsen SJ. Maternal recall of distant pregnancy events. *J Clin Epidemiol* 1998;51:399–405.
- [21] McCormick MC, Brooks-Gunn J. Concurrent child health status and maternal recall of events in infancy. *Pediatrics* 1999;104:1176–81.
- [22] Sou SC, Chen WJ, Hsieh WS, Jeng SF. Severe obstetric complications and birth characteristics in preterm or term delivery were accurately recalled by mothers. *J Clin Epidemiol* 2006;59:429–35.
- [23] Gofin R, Neumark YD, Adler B. Birthweight recall by mothers of Israeli children. *Public Health* 2000;114:161–3.
- [24] O'Sullivan JJ, Pearce MS, Parker L. Parental recall of birth weight: how accurate is it? *Arch Dis Child* 2000;82:202–3.
- [25] Tate AR, Dezateux C, Cole TJ, Davidson L. Factors affecting a mother's recall of her baby's birth weight. *Int J Epidemiol* 2005;34:688–95.
- [26] Walton KA, Murray LJ, Gallagher AM, Cran GW, Savage MJ, Boreham C. Parental recall of birthweight: a good proxy for recorded birthweight? *Eur J Epidemiol* 2000;16:793–6.
- [27] de Winter AF, Oldehinkel AJ, Veenstra R, Brunnekreef JA, Verhulst FC, Ormel J. Evaluation of non-response bias in mental health determinants and outcomes in a large sample of pre-adolescents. *Eur J Epidemiol* 2005;20:173–81.
- [28] Oldehinkel AJ, Hartman CA, de Winter AF, Veenstra R, Ormel J. Temperament profiles associated with internalizing and externalizing problems in preadolescence. *Dev Psychopathol* 2004;16:421–40.
- [29] Brugman E, Reijneveld SA, Verhulst FC, Verloove-Vanhorick SP. Identification and management of psychosocial problems by preventive child health care. *Arch Pediatr Adolesc Med* 2001;155:462–9.
- [30] Reijneveld SA, Verloove-Vanhorick SP, Hirasings RA. Preventive child healthcare (Jeugdgezondheidszorg). In: Mackenbach JP, van der Maas PJ, editors. *Volksgezondheid en gezondheidszorg*. Maarsse: Elsevier gezondheidszorg; 2004. p. 150–60.
- [31] Achenbach TM, Rescorla LA. Manual for the Achenbach system empirically based assessment (ASEBA), preschool forms and profiles. Burlington, VT: University of Vermont, Research Center for Children, Youth and Families; 2001.
- [32] Verhulst FC, Ende Jvd, Koot HM. Manual for the CBCL/4-18 (Handleiding voor de CBCL/4-18). Rotterdam: Erasmus University, Department of Child and Adolescent Psychiatry, Sophia Children's Hospital; 1996.
- [33] Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. *Lancet* 1986;1:307–10.
- [34] Bland JM, Altman DG. Agreement between methods of measurement with multiple observations per individual. *J Biopharm Stat* 2007;17:571–82.
- [35] Cicchetti DV, Feinstein AR. High agreement but low kappa: II. Resolving the paradoxes. *J Clin Epidemiol* 1990;43:551–8.
- [36] Faraone SV, Biederman J, Milberger S. How reliable are maternal reports of their children's psychopathology? One-year recall of psychiatric diagnoses of ADHD children. *J Am Acad Child Adolesc Psychiatry* 1995;34:1001–8.
- [37] Oatley K, Jenkins JM. Functions and effects of emotions in cognition and persuasion. In: Oatley K, Jenkins JM, editors. *Understanding emotions*. Cambridge, MA: Blackwell Publishers; 1996. p. 251–84.